SLOVENSKI STANDARD
SIST EN 15049:2008

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Železniške aplikacije - Vzmetenje - Torzijska vzmet, jeklena

Railway applications - Suspension components - Torsion bar, steel

Bahnanwendungen - Federungselemente - Drehstabfedern aus Stahl

Applications ferroviaires - Éléments de suspension - Barre de torsion, en acier

Ta slovenski standard je istoveten z: **EN 15049:2007**

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21.160	Vzmeti	Springs
45.040	Materiali in deli za železniško tehniko	Materials and components for railway engineering

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Railway applications - Suspension components - Torsion bar, steel

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EUROPEAN COMMITTEE FOR STANDARDIZATION
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Contents

Page

Figures

Tables

Foreword

This document (EN 15049:2007) has been prepared by Technical Committee CEN/TC 256 “Railway applications”, the secretariat of which is held by DIN.

This document shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by February 2008 and conflicting national standards shall be withdrawn at the latest by February 2008.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

Introduction

Work on this European Standard started at the beginning of 2002 with the aim of incorporating the existing documents, such as UIC leaflets (International Union of Railways) and the internal standards of the various railways as well as national standards into one standard.

1 Scope

This European Standard applies to torsion bars made of steel for anti-roll bar systems used on railway vehicles.

This European Standard includes straight and bended torsion bars, but does not detail the other components of the anti-roll bar systems such as levers, bearings, bushes etc.

This European Standard constitutes guidelines on the following topics:

— design;

— specification of technical requirements;

— production requirements;

— tests;

— supply conditions.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 473, *Non-destructive testing — Qualification and certification of NDT personnel — General principles*

EN 10002-1, *Metallic materials — Tensile testing — Part 1: Method of test at ambient temperature*

EN 10045-1, *Metallic materials — Charpy impact test — Part 1: Test method*

EN 10089, *Hot-rolled steels for quenched and tempered springs — Technical delivery conditions*

EN 10204, *Metallic products — Types of inspection documents*

EN 10228-1, *Non-destructive testing of steel forgings — Part 1: Magnetic particle inspection*

EN 10247, *Micrographic examination of the non-metallic inclusion content of steels using standard pictures*

EN 13925-2, *Non-destructive testing — X-ray diffraction from polycrystalline and amorphous materials — Part 2: Procedures*

EN ISO 643, *Steels — Micrographic determination of the apparent grain size (ISO 643:2003)*

EN ISO 1302, *Geometrical Product Specifications (GPS) — Indication of surface texture in technical product documentation (ISO 1302:2002)*

EN ISO 2162-3:1996, *Technical product documentation — Springs — Part 3: Vocabulary (ISO 2162-3:1993)*

EN ISO 3887, *Steel — Determination of depth of decarburization (ISO 3887:2003)*

EN ISO 4288, *Geometrical Product Specifications (GPS) — Surface texture: Profile method — Rules and procedures for the assessment of surface texture (ISO 4288:1996)*

EN ISO 6508-1, *Metallic materials — Rockwell hardness test — Part 1: Test method (scales A, B, C, D, E, F, G, H, K, N, T) (ISO 6508-1:2005)*

EN ISO 9934-1, *Non-destructive testing — Magnetic particle testing — Part 1: General principles (ISO 9934-1:2001)*

EN ISO 14284, *Steel and iron — Sampling and preparation of samples for the determination of chemical composition (ISO 14284:1996)*

EN ISO 18265, *Metallic materials — Conversion of hardness values (ISO 18265:2003)*

DIN 50602, *Metallographic examination — microscopic examination of special steels using standard diagrams to assess the content of non-metallic inclusions*

NF A04-106, *Iron and steel. Methods of determination of content of non metallic inclusions in wrought steel. Part II: micrographic method using standards diagrams*

SS 111116, *Steel — Method for estimation of the content of non-metallic inclusions — Microscopic methods — Jernkontoret's inclusion chart II for the assessment of non-metallic inclusions*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN ISO 2162-3:1996 and the following apply.

3.1
anti-roll bar system
suspension system having an influence on the rolling behaviour of the vehicle. Generally, it includes the torsion bar and any other components

3.2
anti-roll bar
spring bar which is mainly stressed by a torsional moment. It can either be produced as bended bar or a straight torsion bar with levers

3.3
straight torsion bar
straight spring bar which is mainly stressed by a torsional moment

NOTE The term "torsion bar made of steel" refers to the finished end product. For the purpose of simplification, the term "torsion bar" is used in the wording of this European Standard for anti-roll bars with torsion bars of round cross section and made of steel.

3.4
bended torsion bar
mainly U-shaped and manufactured out of round spring material

4 Symbols and abbreviations

The symbols and abbreviations used in this standard are listed in table 1. All parameters are expressed as SI basic units and units derived from SI basic units. Decimal multiples and submultiples of units defined in Table 1 can be used.

Table 1 — Symbols and definitions

Symbols	Units	Definitions
A	%	Elongation at rupture
d	m	Outer diameter of the middle part of the torsion bar
d_a	m	Outer diameter of the torsion bar in the area of bearing
d_f	m	Root diameter of the head profile
d_p	m	Diameter of shrink fit
e	m	Area to take test pieces
F	N	Applied load at the lever
l	m	Distance between load application and middle of torsion bar
L_f	m	Distance between the two load application points
L_a	m	Length between the centre of the two bearings
L_s	m	Length between the centre of the two levers
l_x	m	Crank depth in the middle part of the torsion bar
l_z	m	Distance between load application and centre of the bearing
M_t	Nm	Torsional moment
M_{tmax}	Nm	Max. torsional moment
ΔM_t	Nm	Difference of torsional moments
r	M	Bending radius of bended torsion bar

Table 1 (*concluded*)

Symbols	Units	Definitions
R_m	Pa	Material strength
$Rp0,2$	Pa	Yield strength
R_t	Nm/degree	Torsional spring rate
Z	%	Percentage reduction of area after fracture
δ	-	Depth of residual stress
σ_D	Pa	Residual stress
ϑ	degree	Angle of twist
ϑ_{max}	degree	Max. angle of twist
ϑ_A	degree	Angle of twist at the beginning of stress
$\Delta\vartheta$	degree	Difference of angles of twist
τ_{zul}	Pa	Permissible shear stress

5 Requirements

5.1 Introduction

The component shall be defined in a technical specification which consists of the following documents (see 5.2 and 5.3).

The definition of type of drawing is given in ISO 10209-1.

5.2 Documents to be provided by the customer

The customer shall provide a technical specification including:

An interface drawing (possibly, a general assembly drawing of the mechanical system or a sub-assembly drawing) defining at least:

— the space envelope;

— the functional dimensions and their tolerances;

— the application points of the forces;

— a technical specification detailing at least:

  — the conditions of utilisation (forces, movements, temperatures, assembly, environment, maintenance, storage etc.);

  — the requirements (characteristics of the product, tolerances and expected service life);

  — the approval procedure and type test requirements (e.g. characteristics to be checked and tests to be carried out, order of tests and checks).

The product requirements given in Table 2 shall be defined by the customer:

Table 2 — Elements to be defined in the technical specification and agreed by the parties

Characteristic to be defined	Reference
Space envelope	6.1
Spring rate	5.5
Maximum anti-roll angle or moment, for static (exceptional loads)	5.5
Maximum anti-roll angle or moment for dynamic (fatigue condition)	5.5
Service life requirement	6.2.2
Material	6.3.1
Toughness	8.4
Surface protection	6.4
Marking	Clause 10

5.3 Documents to be provided by the supplier

The supplier of the torsion bar shall provide a technical documentation defining its product, including at least a component drawing.

This documentation shall detail any information required in the technical specification of the customer.

5.4 Design analysis

The principal characteristics of the torsion bar (form, dimension, material, stiffness etc.) shall be determined by the relevant design analysis.

In order to satisfy this requirement, a design analysis, which shall be part of the technical specification, shall define at least:

— calculation method;

— loads and displacements utilised for the analysis;

— the following results:

  — comparison of the calculated functional characteristics with the required characteristics (static stiffness or flexibility etc.);

  — comparison of the calculated stresses with the allowable stresses of the selected material.

The customer and the supplier shall agree on the contents of the documentation and on the analysis method to be used.

5.5 Arrangement and design

The individual bar with circular cross section is the starting point in the design of torsion bars.

The introduction of the torsional moment into torsion bars is mostly effected by rockers which are connected to the torsion bar ends through positive or non-positive locking. By means of the rocker, a force acting vertically

with regard to the bar axis is transformed into a moment and the resulting torsion of the free torsion bar end into a displacement of the force introduction point.

The transformation of a vertical movement into a torsion bar attained by means of the rockers allows this combination to be used in an advantageous way as anti-roll device of rail vehicles.

The arrangement of the torsion bars as anti-roll device in the rail vehicle is effected in transverse direction, the bar axis being for the most part aligned parallel to the track plane.

A principle representation for the purpose of symbol illustration is shown in Figures 1 and 2.

The torsion bar (antiroll bar) and the stabilizer are working around zero position with alternating loads. They are not pre-tensioned during manufacturing.

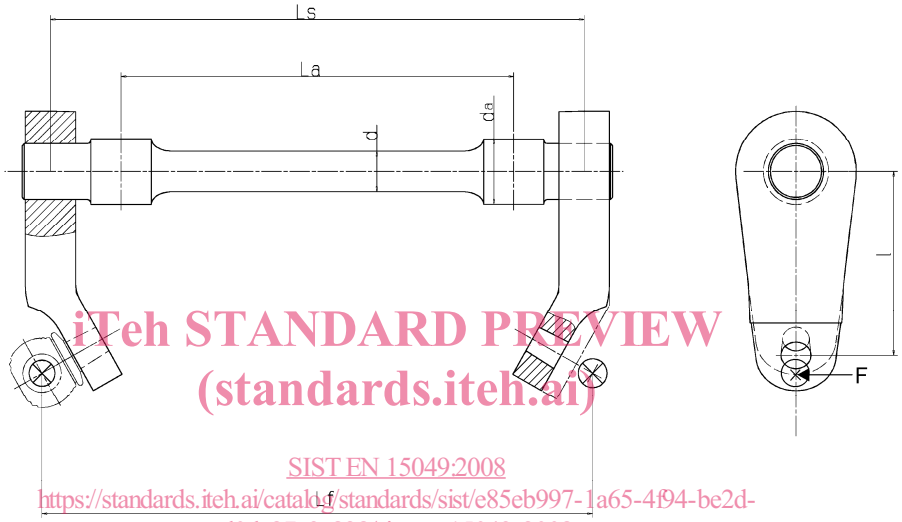

Figure 1 — Example for a straight torsion bar with mounted levers

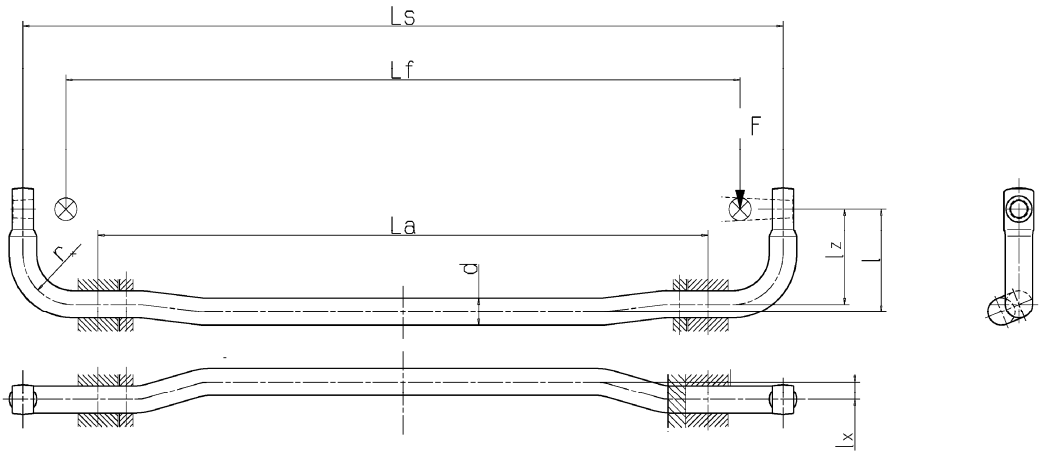

Figure 2 — Example for a bended torsion bar